



## Philip Handler: a parting look at science today

*He has never claimed the title. But in many respects Philip Handler has been the vicar of science for the past 12 years. As president of the National Academy of Sciences and chairman of its operating arm, the National Research Council, he has played a central role in the fortunes of the scientific enterprise in this country and especially in its relationships with government—by far the largest source of research funds.*

*NAS is science's ultimate honors society—it has been dubbed the profession's college of cardinals. NRC is the government's primary source of advice on science-related matters.*

*Handler is now leaving. His second six-year term is over and that is the statutory limit. His successor is Frank Press, a close personal friend and former science adviser to President Carter.*

*On one of his last days in office Handler sat down with C&EN editor Michael Heylin to pass on his views on the state of science in the U.S. today—its strengths, its triumphs, its internal problems, and its relations with government and with society at large.*

*He is obviously sorry to go. There is little doubt that he has relished these past 12 years. He talks with pride of the changes that have come to NAS and to NRC in these years. At the interview he is mellow, relaxed. "Take all the time you need," he says, "the business of this institution is slipping away from me." He apologizes for the disarray in his partly cleared out office with its now emptied bookcases.*

*His views reflect, besides great hope for the practitioners of science, many of the conflicts, contrasts, and contradictions within science today. He sees the scientific enterprise as vigorous, glorious, and never more productive. He also sees it as well regarded in the eyes of government. However, he also sees it carrying on in some "disarray, disorder, and even despair" with ever increasing strains in its relationship to Washington.*

*He is also proud of his role in helping to force the Soviet Union to accept a direct linkage between human rights and international cooperation in science under the Helsinki accords, something that could imperil the free flow of scientific information. Yet he is also disturbed that NAS has had to cut off its program with the Soviet Academy of Sciences as the only way it could protest Soviet treatment of physicist Andrei Sakharov, a foreign associate of the academy.*

*Handler was not asked, and did not identify, what he considers the most critical issue facing science today. But he does state that the principal reason he regrets leaving the academy is that it will remove him from a key role in what he thinks is a vitally necessary examination by the scientific establishment of the premise that ever more sophisticated weaponry is the primary route to national survival.*

*A biochemist by trade, Handler came to NAS from Duke University where he had been on the faculty since 1939 and chairman of its biochemistry department for almost 20 years. He will return to Duke in a teaching role after a summer at Woods Hole, Mass., where he hopes, among other things, to find time to enjoy the boat he and his family share with the Press family.*



Photos by C&EN's David J. Hanson

**C&EN:** Maybe we can start on a positive note. You wrote recently in your last president's report to the National Academy of Sciences that U.S. science is a glorious, vigorous, flourishing enterprise; alive with excitement and fresh surprises; and never more productive than it is today. So presumably you see U.S. science today as being in a golden age.

**Handler:** That is not an unfair description. Most of us seem to spend much of our time concerned with the problems, the difficulties, the awkwardnesses, the limitations of the federal budget. If you simply look at the science itself, it is just glorious and that's the reality. To be sure there are some senior scientists who don't have as much support as they would like and we might think they merit, and there are younger scientists who are apprehensive. But the great bulk of the truly competent scientists of the U.S. are busily engaged at their science, which is going like a house on fire. What more can we ask?

**C&EN:** Is this a continuation of a long steady growth or is it somewhat of a resurgence over the past 10 years or so? I remember a time when there were grumblings that science did not have the quality it once had—that a lot of lower-quality papers were being published. And that the proliferation was at a cost in quality.

**Handler:** Those statements could be made again today. Surely, there must be a spectrum of quality. There will be the super, the very good, the reasonably good, and some shoddy work that will slip through. That will always be true. The question is, how good is the very good? Is it leading us into new vistas, giving us new capabilities, new understandings? All the rest has to be there to underpin the very best. If the entire effort isn't all going on, the very best won't happen.

There was a depressed mood going back to the Vietnam years. I don't sense that depression in our scientific community today. I sense a struggling for funds. There must always be struggling for funds. If it stops, we will have put too much money into the system. I don't know whether the present amounts are just right; I doubt it. I am sure we could benefit by a modest-size increment in the total. But I do not sense that previous sense of the scientific community that things are bad and are going to get worse.

**C&EN:** Did this depression cover something like 1965 to 1975?

**Handler:** Yes, more or less—1968 to 1973–74. The general mood has improved not particularly because scientists have flourished but because of the mood of the country. Even when the President and Congress could not provide quite so much money for science as they seemed to intend to provide, the scientific community did not have the sense that the rug was being pulled out from under it. There has been the sense of having a fair shake. Starting with President Ford, each incumbent in the White House has thought that the scientific enterprise is a significant aspect of our national life that warrants strong support. That notion has gone unchallenged in the Carter and Reagan Administrations.

**C&EN:** I believe you have said you feel that the U.S. still has a lead in all major scientific disciplines.

**Handler:** Or we are even up, surely. I cannot think of a discipline in which we are really seriously outclassed somewhere in the world. For instance, I can't think of anywhere where the quality of general chemical research exceeds ours. The Soviets are doing pretty well in certain areas, as in electrochemistry, for example. But we are running a fair race. I don't know any area in which we are just genuinely outclassed and have a long way to go to play catch-up. If you ask scientists abroad they think we are way ahead of everybody. They think we are just years ahead of them in capability and in the drama of the science that we do.

**C&EN:** In general, presumably, you still have supreme faith in the "Science the Endless Frontier" concept as spelled out by Vannevar Bush after World War II. Do you feel that this idea that government funding of R&D will bring enormous benefits to society has been proven in the crucible?

**Handler:** It depends on what you really mean. Science is not the answer to all our social and economic problems. Surely not. Science is a superb handle on the future, a superb tool to give us capabilities with which to manipulate that future and to see to it that it is optimized to the extent possible. It has made possible the extraordinary strength of American agriculture, extended our lives, underlain the economy at all its growing edges. Our science has been coopted by other nations. It has gone a long way in supporting economic growth for Japan, then Taiwan, Korea, Singapore, Hong Kong, and the like.

But there is confusion and uncertainty about the national security end of things. That is a matter to which you have recently spoken and to which I have called the attention of our members. There should be a great debate into which I hope the nation will enter. We should not just dust it all under the rug and keep going. There are many serious questions that need examination and resolution before we make huge national commitments.

What is certainly true is that somewhere else on the planet there is another nation that views itself in an adversarial way with respect to the U.S. We have little choice but to maintain the strength of the R&D which upholds our own security position. But there are questions, as well you know. To return to your question, the basic concept of "Science the Endless Frontier"—that the whole country will benefit from science—is still true.

**C&EN:** You comment in your last report (1980) to NAS that science today is carrying on in some "disarray, disorder, and even despair." So I assume that this scientific flowering from all the more or less unplanned structures which were put into place in the 1950's and 1960's is now in some ways going to seed.

**Handler:** Only somewhat. We have major laboratories that have lost their sense of mission. There are places where people have made false starts—but there always will be. There are young people who think the system is not giving them a fair shake in science although it is at least as fair as it used to be.

**C&EN: Is the frustration over finding funds?**

**Handler:** Yes. This country runs a system that is unique. Our young people are given the opportunity to get off to a flying start so much earlier than anywhere else in the scientific world. This means that they grow up with less sense of shelter and protection. At the moment they are caught up in the forces of inflation and many can't find quite enough money with which to work—so they tell me when I go wandering about. I still think the opportunity for early independent research is so precious that they are far better off under our system than any kind of sheltered system.

**C&EN: There is a certain amount of talk, even alarm, these days about the decline in science education in high schools, especially when it is compared with apparent gains for science education in the Soviet Union and elsewhere.**

**Handler:** I am deeply, deeply troubled by it.

**C&EN: You feel it is real?**

**Handler:** Oh yes. This may well be the largest, most difficult single problem the country has. There are two pieces to it—the supply of tomorrow's scientific and engineering leaders and the capability of our general labor force. In our postindustrial society, the latter may be more serious than the former. For some years we have witnessed declining SAT [Scholastic Achievement Test] scores for high school students applying for college entrance.

I guess many of us were not alarmed because we thought the best, the brightest would find their way anyway. But that is not what the data say. The data say that the decline in the numbers of scores over 600 and 700 is just as serious as the decline at the mean. The distribution under that curve hasn't changed, the whole curve has sunk. Restated, that says that out there there are a significant number of bright and talented young people who, for some reason, are not working in a manner that allows us to identify them. That is very scary.

**C&EN: Are the data from the Soviets real?**

**Handler:** I don't believe all of them. We know what their goals are, rather than what their performance is. The statement is that last year the Soviets graduated from secondary schools 2 million youngsters who had had two years of exposure to calculus. We graduated 100,000 who had some exposure to calculus. Granted the exaggerations in such numbers, it is still very, very awkward. The problem is where did the Soviet Union find all those teachers?

**C&EN: And do they really have 2 million kids who could legitimately handle calculus usefully?**

**Handler:** I don't know. But we must believe they are making a very large effort. Becoming a scientist or an engineer is a much clearer pathway to upward social mobility in the Soviet Union than it is in this country. In fact, it is the only sort of committed pathway. Nothing else they can do as they go through the school system in the Soviet Union has so much of an opportunity to guarantee what they will do later. And so it is very attractive.

**C&EN: Then, at least in broad terms, these differences are real. The impact on science in this country could come quite quickly. Within the decade?**

**Handler:** If you mean the leading edges of science, I hope that we will still be out front. I am more worried about the impact on the performance of technologically based industry. We will have workers who can't follow directions, analogous to the undereducated people in our military being asked to manage high-technology weapons.

**C&EN: Apparently that problem already is manifesting itself.**

**Handler:** If we next see it at IBM, GE, and Boeing we will be in very serious trouble.

**C&EN: I assume that all this is obviously related to your thoughts on the wisdom of cutting out the NSF budget in the education area.**

**Handler:** I don't know that NSF has the capability to deal with the problem. The origins of the problem in our country are multiple and difficult. They are social, economic, cultural. They have to do with the changing mood of the country at different times. The problem is not purely financial. Nor is it the adequacy of curricula. We have more than adequate curricula for the youngsters, if they would go through them. The question is how to hold their attention and their motivation, how to maintain discipline in the schools, and how to make learning itself seem like an important experience rather than something to be escaped as easily and rapidly as possible. That is very complicated.

**C&EN: But NSF could have played a role.**

**Handler:** Yes. The curriculum development work it did for 15 or 20 years came out very well I thought and provided material that would serve us well. That it has not been adopted so widely as one could hope is one of the symptoms of the difficulty.

**C&EN: Would you elaborate a little on the problems that seem to be developing in the relationship between the federal government and research universities?**

**Handler:** Many of us have watched this process in a troubled frame of mind now for some years. It is a historic process which finds its origins in World War II when there were facilities in place at universities and professors available. Our government used these resources for some of the R&D for the war and thereafter the process continued. In my mind Vannevar Bush's report "Science the Endless Frontier" was the major signal. It stated the credo, but it didn't consider the necessary ground rules.

The ground rules were evolved by people who had no sense of how large this system would be. As the scale of it grew it came to be a larger and larger component of life at the universities. Then schools found themselves having a harder and harder time generally because of inflation. And they came to look increasingly toward reimbursement of 100% of the indirect costs. They began to manipulate the system somewhat. And that provoked response from the government which began by paying a token 5% indirect costs. It then paid 8%, then 10%, and so forth until it is now up to more or less 50%. The con-

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**C&EN: It is still government money.**

**Handler:** Yes. And I suppose conditioned the way highway patrolmen are—you have to give out a certain number of tickets. And if you are an auditor you have to make some disallowances. They can't make last year's disallowances because we didn't do that again. So they make new ones and so keep raising the level of irritation. That is happening on campuses all over the country.

**C&EN: So you are asking for a fairly subtle administrative change?**

**Handler:** Yes, it has to be subtle, psychological more than material. I don't think the universities should get away with anything. They should not get more than they are due. Indeed, I am not sure they should have all they are due; there should always be a positive university financial contribution from whatever source—private money or state money or whatever.

Our committee believes in the mission. We are asking them to write another version of "Science the Endless Frontier," but in 25 pages. What prescriptions are there? What advice can one give the government, the universities, the scientists? How can we move into tomorrow with the idea that the federal government will remain the most important single source of funds for fundamental research?

**C&EN: Is this committee looking into some of the other problems—such as the pressure on universities to meet government regulations that are totally unrelated to the science function and the problem of distributing R&D funds geographically?**

**Handler:** Yes. Such questions are inescapable. The committee met in April for the first time. I hope it will have a report for July 1 next year.

**C&EN: You have personally expressed a lot of concern about these two other areas.**

**Handler:** I consider that it isn't cricket for the federal government to use the flow of research funds as a sanction to be imposed to enforce laws and regulations that have nothing to do with research. That has made me very, very upset on several occasions. It is a very powerful weapon in the hands of the government. Universities have no staying power, they cannot tolerate a shutoff of the flow of those funds. One month and they are bankrupt. So it is just such an extraordinary weapon to be brought against them.

**C&EN: But this is such broad practice today. How can you say that it shouldn't apply to science?**

**Handler:** Agreed, it is the only leverage the government has. The government has no other mechanism with which to exercise control over universities but the flow of money in support of research. But the government also has created a set of social regulations—affirmative action, equal employment opportunity—it wants enforced. The weapon—the threat to cut off all research funds—is a monster compared to the problem with which it deals. That's what gets me.

**C&EN: Changing the subject, you recently wrote, "We ask, nay demand, that the scientific community**

sequence has been a continuing increase in tension. The relationship has become less and less comfortable. To satisfy Circular A-21 professors are expected to lie since they are not going to know the information they are asked for. And life on campus is just not what it used to be.

**C&EN: You quote someone as saying, "It's not fun anymore."**

**Handler:** Yes. I have asked a committee of the academy to pretend it is 1950 again and we are inventing the system but with the foreknowledge that one day \$5 billion per year will flow from the federal treasury to the universities. It is about \$3.7 billion now. Then ask, what are the terms of the bond? How should the two relate to each other? What really is the responsibility of the federal government to see to it that universities are viable? How best to manage the payment of scientists' salaries? To what extent can we protect the working scientist from having to deal with an excessive amount of paper and regulation? The current relationship between the university and the campus is a partnership, as viewed by the more enlightened program-managing bureaucrats of Washington. But it is an adversarial relationship as viewed by the auditors on campus. What is required is to optimize these relationships.

**C&EN: Who are these auditors? University personnel?**

**Handler:** No. On most campuses they work for the Department of Health & Human Services. They are the resident auditors who audit the books of, say, Cornell University on behalf of the U.S. government. They audit all government accounts. Here at the academy we have three auditors in residence. They never leave us. They are from the Defense Contract Audit Agency and they have been since World War II. They rotate—perhaps every year and a half. Then they leave and the next crew comes in. Their last experience was at Lockheed or Martin Marietta or General Dynamics and they don't think we are any different!

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**be adequately consulted in regard to certain government appointments." Is this an old problem?**

**Handler:** It is a continuing problem. The political apparatus of each new Administration wants a free hand. On our side, we have thought that people like the director of NIH, the head of the Geological Survey, the director of NSF, the head of the space agency, the head of the Parks Service, and the head of R&D for the Department of Defense (DDR&E) are the senior professional positions for scientists in government. We would be happy if their appointments rested entirely on their scientific credentials and would not necessarily change with Administrations.

With the passage of time it has become more and more clear that life isn't going to be that way. If the new President wants a new administrator of the National Oceanic & Atmospheric Administration (NOAA), for example, he will have a new administrator of NOAA. However, I think that we must still ask that the relevant scientific community have the opportunity to vet the process—to make nominations, to screen nominees who come in through other channels, and generally assure ourselves of the competence of the candidates. Their politics need be none of our concern unless they are antithetical to the views of the relevant scientific community.

**C&EN: Has this normally been done?**

**Handler:** It has been spotty. For the director of NSF it is spelled out in the act.

**C&EN: That is the least political of these positions.**

**Handler:** Yes. The last time the post of director of NIH was filled, Caspar Weinberger, who was Secretary of Health, Education & Welfare at the time, called me. I assembled a panel. We brought him five names, ranked. He took the first name.

**C&EN: You can't complain about that one.**

**Handler:** By tradition we always have participated in selection of the head of the Geological Survey. And James Watt, the new Secretary of the Interior, so asked us, just as did his predecessors. Again we created a small panel and gathered in hundreds of names. We delivered a list of five to Watt. From what I have read in the press, he has picked one of the people on our list. But we—the academy—weren't asked about NOAA. We weren't asked about the space agency. We weren't asked about DDR&E. We have been asked recently about the Parks Service. I don't know whether the Secretary will ask us about NIH, which has just become open again.

**C&EN: Has there been a traditional involvement for DDR&E?**

**Handler:** No, there has not been. Perhaps we shouldn't have a role here. Indeed, our members might even be uncomfortable with such a relationship. They may not want us to have that responsibility.

**C&EN: Was it the delay in appointing the science adviser that particularly incensed you this time?**

**Handler:** I don't think I was so incensed. I really was making the other point—"Friends, give up on the idea that someone who runs a billion-dollar-a-year federal agency has a professional job free of the winds of politics." We in the science community have said that before and sounded foolish to politically astute individuals.

The director of the Geological Survey runs a show which is responsible for what the U.S. thinks it has by way of mineral resources in the ground. His job is immensely important to our national life. To think that he is a pure scientist accountable to the earth sciences community but unaccountable to the political process is silly.

**C&EN: Is it fair to say that the traditional science establishment had very little role in the Keyworth appointment as science adviser to the President?**

**Handler:** The way you have cast that question makes it difficult to respond. Keyworth knows he was not the first choice. He is well aware that a number of well-known people were on a list and were asked. For reasons known best to them, they declined. There came a point when the principal working parts of the White House said to those who were managing the search for a science adviser, "Now you bring us someone who will say yes, and who you think has the proper tickets." As a result of that we have Keyworth. And that may yet prove just great, it just may.

In sum, rather than individually, those well-known names who declined did the nation a disservice. The search group should not have trotted out before the White House names of people who were going to say no. That isn't the way this game should work. It just becomes embarrassing. Any new Administration will become very resentful of any such process. And you can't blame them. The idea of senior scientists actually saying "no thanks" directly to the President of the U.S. is really not an acceptable way to do this.

**C&EN: It doesn't help science.**

**Handler:** That's right. And the nation loses in the end. The lens through which the Administration sees the science community and what it does begins to get cloudy. Science looks less friendly.

**C&EN:** President Reagan has been almost totally nonspecific about science.

**Handler:** Yes. But if you read the "black book" and the "white book" through which the new budget was revealed you can get some idea of the Administration's thinking.

**C&EN:** Do you see some ominous signs there?

**Handler:** You see ominous signs. And yet you also see good language. The several statements of "this we believe" could be adopted by the science community without difficulty. Then there are the specific actions that are very troublesome—the brutal cut in social science funding and the elimination of NSF's educational effort, the less than thoughtful handling of international science. What they did for the natural sciences at NSF and elsewhere was highly supportive. Many aspects of the Carter R&D budget stayed intact.

**C&EN:** You seem particularly encouraged about the Department of Defense getting more involved in university R&D. I think what you are saying is that this will help build up a new cadre of scientists who have better knowledge of DOD and its problems that, it is hoped, will remain somewhat independent in its thinking.

**Handler:** Exactly so. First, I think it healthy that scientists generally work with DOD, become acquainted with its problems, and help when they really can. Second, I have been troubled by the fact that one of the prices of the Vietnam War has been the genuine development of what President Eisenhower called the military-industrial complex—a black box into which the rest of us do not peer. In the 1950's and 1960's when the military-industrial complex was formed there was a very considerable cadre of scientists, largely those involved during World War II, who stayed on and had good insight into weapons development. The President's Science Advisory Committee was an especially useful mechanism in that regard. Then President Nixon killed PSAC.

**C&EN:** Was PSAC purely military?

**Handler:** By no means. When it began its business was largely military. Then it turned its attention to space. And then to many other aspects of science in government. But it always had a big military component. It saw itself as a friendly critic of the military in the White House. Its business was to be knowledgeable concerning the R&D being performed by DOD and about what the military intended to acquire and deploy. It was a knowledgeable group which could examine proposed new military technology on behalf of the President, who otherwise had nothing available to him but what would come from DOD itself—which is quite capable of putting on a snow job.

**C&EN:** I have been exposed to that.

**Handler:** PSAC was not antimilitary, it was a built-in screen for the President. It's gone. It does not exist today. The result is, this concept of black box could become very significant.

**C&EN:** While this was being done, was it favorably viewed by the science community at large?



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**Handler:** Yes, before the Vietnam War, although I can't say that PSAC's role was widely known. The scientific community did its part in the cold war. It was not antimilitary. PSAC's role was to say, "Please sir, no technical monsters—no vastly expensive acquisitions for little gain in security." They were playing on the same team as the military, but free to make an independent judgment. Today that is not so easily done. The Defense Science Board doesn't play that role inside DOD. I would wish that some such mechanism could be reconstituted. I see little chance that Keyworth will have opportunity to do so. He won't have the resources.

**C&EN:** Maybe not the inclination?

**Handler:** That I can't say. He has spent his life in a weapons lab. As we said there is another way in. That's to develop a significantly sized external scientific community with frequent day-to-day relationships to the military. Some will work on classified, but most on unclassified, materials. They will develop a familiarity with the military and the military's requirements, programs, and aspirations. The totality of that can constitute a sort of informal monitoring system.

**C&EN:** You think this can be done and they won't be coopted?

**Handler:** There is always the danger of cooption—always. It will be a matter of whistle blowing in this relationship. But whistle blowing is a danger to the whistle blower. Conversely, the word gets out and the scientific community begins to talk. So there needn't be an odd individual at risk. It will not be an organized thing.

I was very discomfited when, as a consequence of Vietnam, our entire national scientific community, except those working in the military establishment itself, was turned off against the military. In a country that has fought its wars with citizen soldiers, you can't have the scientific community thinking that somehow the entire military establishment is a great evil—and therefore let it be free to do whatever it pleases because we won't have

anything to do with it. That's wrong. We don't want to lick 'em. We have to join them to make sure it comes out right.

**C&EN:** This thing gets so convoluted when, in one way or another, 60% of federal R&D is defense-related. How does this distort the whole science effort?

**Handler:** For the moment, of course, we have a primary article of faith that says our national security does, indeed, rest on the success of our scientific and technical enterprise. True or false is another matter. But that is still the first article of faith. Second, defense R&D represents a huge chunk of our R&D resources and of our pool of human talent that might be otherwise directed.

Military R&D not only commands so large a fraction of our most advanced work and financial resources, but it attracts a disproportionate fraction of the best and the brightest. Because of the very challenges, it is exciting. Military scientists do these exotic things at the advancing frontiers and have available the resources to do them.

But in the outside world we face two sets of adversaries. On the one side there is the Soviet Union where they do almost no domestic kinds of R&D—we don't worry about the Soviets in the international marketplace. But they push their military R&D. So we have to have an arrangement to match that. Meanwhile, there are Japan and West Germany, for example, doing almost no military R&D and where their best and brightest are happily designing things to sell in the American market. We are having to compete in both of these worlds. That makes it very difficult. But I don't see that we have a choice.

**C&EN:** Is the premise that ever more sophisticated weaponry is our only route to national survival one that the science community should in some organized way be examining?

**Handler:** That question is the principal reason I regret that I am about to leave here. I came to that conclusion this year very, very strongly. I have been much impressed, I must admit, by the writings of James Fallows [Washington correspondent for *Atlantic Monthly* and author of "National Defense" recently published by Random House]. There may be major errors, but there is a strain of truth through his writings that is very compelling. That recent television program that you wrote about—the CBS series on the defense of the U.S.—was very powerful.

I began to get very itchy about these matters more than a year ago. The sense of it kept mounting with me. I had distributed the Fallows writings to the council of the academy. The point is that the question has changed. For years one would read statements to the effect that the large expenditure on our military through high-technology military weaponry was a great big ripoff of the American people. The complaint was essentially about finance—about money being taken out of the Treasury and put in this wasteful pot. Relatively recently the question has changed. It isn't so much about money, it is about how effective is national security. The first question was a political, dirty question that I didn't think was the business of the scientific community. The second question has a large technical component and is the business of the technical community. And this requires a genuine national debate.

**C&EN:** Doesn't much of this debate have to focus on strategic nuclear weapons?

**Handler:** Yes. Our policy on nuclear weapons is the central fact of our national life. We are very serious about that at the academy. As you know, I have appointed this committee chaired by Marvin Goldberger, president of California Institute of Technology, on international security and arms control. As we speak, a portion of the committee is in Moscow meeting with a counterpart Soviet group to ascertain whether we can agree on an agenda and engage in a regular series of discussions. The first reports are decidedly encouraging. It is not inconceivable that our talks will set the stage for bilateral governmental negotiations to which we simply must return.

**C&EN:** You set up this committee about a year ago?

**Handler:** Yes. The committee is a balance of hawks and doves. It is a tricky committee to put together.

**C&EN:** Do you think this could be a mechanism to trigger broader discussion within the scientific community?

**Handler:** The entire exercise is intended to be catalytic. We can never come to any agreement. We sign no papers. All we can do is lay a flooring, a groundwork, and let the government come in. But the discussions are private, confidential, and not themselves the stuff of which broader discussion is made.

The notion that there are 40,000 (tactical and strategic) nuclear warheads deployed by the U.S. and the Soviet Union is so mind boggling, so absurd.

**C&EN:** And there are programs to deploy thousands more in the next decade.

**Handler:** That siting plan for the MX (intercontinental ballistic missile) just drives me up the wall.

**C&EN:** It is interesting in that the MX did get quite a lot of public debate. But most of it was on the environmental aspect.

**Handler:** That's right. It was not about "do we need this weapon at all."

**C&EN:** What is your view?

**Handler:** I have a hard time believing that any salvo of Soviet missiles could be so successful as to render all our intercontinental ballistic missiles useless. And we have overkill by such an immense margin now. The deterrence of the current triad (intercontinental ballistic missiles, submarine-launched ballistic missiles, and bombers) is so great. I cannot imagine the Soviets trying a first strike. They know they can't get away with it.

**C&EN:** Yes. But the fear of such a first strike is the major rationale for the MX.

**Handler:** Yes. Do the 20,000 (strategic) warheads have to become 40,000? Is there any more security at that level? There is less. The bigger that armament gets the more jeopardy for the country, as far as I can see. As you know, I also, conversely, have the sense that we mustn't reduce back to zero. Each side ought to have a few dozen, so each can deliver an absolutely devastating blow to the



other. And the other always knows it. Neither can preempt. And that would be lovely. It would also deter conventional war, I hope.

**C&EN:** What hope do you see of a general response from the scientific community? I know, we have tried to do some of this in C&EN. I think attitudes are changing slowly. But when you talk to chemists they generally say, "It's not chemical, it has nothing to do with my discipline."

**Handler:** That is true of every section of the scientific community. And it is time that the primary problem is political.

**C&EN:** Then how can the scientific community best get involved?

**Handler:** It is the monitoring process, the stepwise negotiations, the credibility of statements concerning performance of individual weapons. Each side always will be terribly nervous if it agrees to an arms cutback. Each side will want to know that it can believe the other side is doing what it has committed itself to do and that no surprises are being generated. A special role of the scientific community is being part of the monitoring machinery. Because without that, nothing will happen.

**C&EN:** I imagine you are somewhat alarmed by some of the things that have been said in Congress recently concerning higher funding for development of weaponry in space?

**Handler:** It is very alarming and a reason for looking at the shuttle with less than totally sympathetic eyes. Right at the moment, the whole business of weapons of this kind—particle beams and lasers—is still kind of science fiction. I am not sure about particle beams, but lasers with enough power will likely be deployed, not as weapons against ground targets, but against other satellites and perhaps as a ballistic missile defense.

**C&EN:** This would be a colossal undertaking.

**Handler:** The technical challenges are enormous. Yet I see little chance of not going down that trail unless we learn to negotiate arms control with the Soviets.

**C&EN:** Let's move on to a new topic. I know that personally you have been very involved in this matter of international relations and science. You have agonized over the need to make some significant gesture about Soviet human rights violations, on the one hand, and the desire to keep the exchange of scientific information unimpeded on the other—in other words, the use of science as a weapon, a pawn in international politics. From what I gather, you have very mixed emotions about this.

**Handler:** I do indeed. It has been very difficult. An analogy is the one we talked of earlier about the government cutting off all money for research as a sanction for violations of unrelated laws. In this instance, seeking to make it as clear as we could to the Soviet government how deeply we feel about the fate of Andrei Sakharov, we used the only kind of signal that was available to us, suspension of our small program of bilateral seminars. It is a signal I am uncomfortable about using because I really do be-



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lieve that communication and cooperation in science is what it is all about. And deliberately to cut off some part of that process is intrinsically a very painful act.

It is made more complicated yet by the understanding that the very Soviet scientists with whom we are about not to communicate are really helpless in their own country. They do not make the decisions. They do not even have access to the people who do, at least so they tell us. So why bother with them, as it were? The answer is, it's a signal to those other potentially powerful people.

In 1973, the first time we ever caught wind that Sakharov was in danger, I sent a cable which essentially said, touch him and we will cancel our whole exchange program. They did not touch him. He sent me a letter in his own handwriting thanking me and assuring me that our message had had a telling effect. But it is a game you can't play every year. We have already cried wolf.

**C&EN:** You have played your China card.

**Handler:** This time we sent a modest signal saying these matters still concern us deeply. It hasn't done Sakharov any good that I can detect. He is still in Gorki, his circumstances deteriorating. His access to even the Soviet scientific community is declining. So one may argue that we have painted ourselves into a corner. The Soviet government will not relent and we have no excuse for reversing our decision. In the absence of any reasonable response mitigating Sakharov's circumstances we shall live with the action we have taken.

**C&EN:** This matter went a step further in Hamburg last year when formal linkage was achieved between human rights and scientific exchange. This was the meeting of scientists representing the 35 nations that signed the 1975 Helsinki accords on European security, cooperation, human rights, and the free flow of information and ideas.

**Handler:** The outcome of the Hamburg meeting was far more favorable than anything we thought we could gain before we went. As you know, there are statements about



human rights in Basket I and Basket III of the accords whereas the statement about communication and cooperation in science is in Basket II. Since Helsinki, the Soviets have held that there was no linkage—you don't have to behave by the rules in Baskets I and III in order to reap the benefits of Basket II. We have said otherwise. At a later review in Belgrade of the accords, the Soviets would not allow a single word about human rights in the final communiqué.

**C&EN:** But the link that was made in Hamburg has not been changed by what is now happening in Madrid?

**Handler:** No. The Madrid review of the accords will not change this. In Hamburg, we got them to agree specifically to the fact that cooperation in science is contingent upon respect for human rights in the countries so engaged. Our State Department was amazed.

**C&EN:** In the long term, doesn't such direct linkage between science and human rights have its perils? Conceivably, foreign scientists may one day get somewhat disturbed about some actions of the U.S.

**Handler:** Why not? We are not exempt or immune.

**C&EN:** But such linkage can put restrictions on the free flow of science.

**Handler:** Well, we are part of the whole world. Scientists aren't any more special than other people. We act on behalf of scientists because they are the people we know, to whom we can relate. And other folks will have to defend the shoemakers. That's the way it is. When we sent a team to Argentina and Uruguay and it came back with tales of torture of scientists, I squirmed. If, to some extent, the great American strength in science and technology offers us leverage in trying to improve the position of scientists in other countries, I am all for it. It will exact a cost from us from time to time. Science is a human endeavor. It's about people in the end. It can't be held out there as some strange objective thing that doesn't relate to the world in which people function. It must not. It would be a terrible mistake. It would be akin to the Nazi scientists who thought they could do all those crazy experiments with people because people had lost meaning and value.

**C&EN:** In what state do you perceive you are leaving the academy, in terms of its stature, prestige, and role within the scientific community and the community at large?

**Handler:** Are you asking me: "Am I pleased with what I did for 12 years?"

**C&EN:** Yes.

**Handler:** To respond is a great arrogance, but I'll make a small try. First, I do believe that 12 years later we have utilized ourselves, or have been utilized by the government, in quite a number of instances in a positive beneficial sense—matters have come out better because we were part of them than they might have if we hadn't been involved. I think I could furnish quite a list. Two, on the Washington scene generally the institution has more presence than it had when I arrived. There is more con-

sciousness of our potential usefulness on the part of both the executive branch and Congress. There had been only one Congressional request to the academy before I came. Now we get one per month, more or less.

**C&EN:** Are you now satisfied with the more organized way the academy is appointing its committees, screening its reports, and so on?

**Handler:** Yes. Surely my major undertaking was to revise the whole structure of the National Research Council (the operational arm of NAS) and how it functions. We have built in effective quality controls it never had. Also, we have built in institutionalized decision-making capability of real competence. This effort generated no inconsiderable amount of trauma inside the institution—bruised feelings, frictions, tensions. But it has also seen to it that there have been relatively few real boo-boos in the reports we have produced. The general quality of the reports surely has been decidedly superior to what would have happened otherwise. I became concerned at the prospect of persons in conflict serving on our committees long before others around here were willing even to think about it. Our screen against potential sources of bias has been very effective with but a handful of exceptions. There have been some dillies.

**C&EN:** Your goal has been to find bias and then either eliminate it or to introduce appropriate balance.

**Handler:** Yes. It is not that we object to bias, as such. But let us make sure the committees are balanced.

**C&EN:** There have not been too many storms around your ears lately, have there?

**Handler:** No. We had the big cholesterol flap. Regrettably, the press's attention went to ad hominem matters. There has yet to appear any credible evidence that the committee's conclusions were incorrect. We did not know at the time that there really was a kind of establishment dedicated to belief in low-cholesterol diets—it had become almost religious. We were naive.

The other big boo-boo, the biggest one we pulled, reflected failure of our report review system. That was our report on the Veterans Administration hospitals. There were 33 recommendations. One week after the report appeared the administrator of VA announced they were accepting 27 of them verbatim and were going to implement them starting the next week. There were five that they had to think about. And one sent them up the wall. This was to plan to close the VA hospitals. I was in China when that report was finished. On the day I got back I found on my desk the press release and a summary of the report. I read it in utter dismay.

**C&EN:** It was already out?

**Handler:** Yes, I had been gone for several weeks. I had never heard that this was on the 33rd recommendation. What a perfectly awful flap. If the report had merely pointed out the social, economic, and demographic problems and said that Congress has a terrible problem with which to deal, and let it go at that, nothing would have happened. But the committee also offered a solution—one that politically was utterly unacceptable. That was their mistake. Oh! Did the blood flow. □